Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

REED CLARK ROLLINS, Editor-in-Chief

ALBERT FREDERICK HILL
STUART KIMBALL HARRIS
RALPH CARLETON BEAN
IVAN MACKENZIE LAMB
ROBERT CRICHTON FOSTER
ROLLA MILTON TRYON
} Associate Editors

Vol. 63 June, 1961 No. 750

CONTENTS:

Synopsis of the Genus Xanthocephalum (Compositae). *Otto T. Solbrig* 151

Roots and the Taxonomic Differences between Botrychium oneidense and B. dissectum. *W. H. Wagner, Jr.* 164

Two New Orchid Records for Ontario. *H. Andrews* 175

A Range Extension for Parapholis incurva. *R. J. LeMaire* 176

A New Species of Haplopappus from Mexico. *Marshall C. Johnston* 177

Contemporary Notes on Powell's Expeditions in the West *(Review). Joseph Ewan* 179

The New England Botanical Club, Inc.

Botanical Museum, Oxford St., Cambridge 38, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of North America and floristically related areas. Price, $6.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) 60 cents. Back volumes 1-58, with a few incomplete, can be supplied at $5.00 per volume. Volume 59— available at $6.00. Somewhat reduced rates for complete sets can be obtained upon application.

Scientific papers and notes, relating directly or indirectly to the plants of North America, will be considered by the editorial committee for publication. Articles concerned with systematic botany and cytotaxonomy in their broader implications are equally acceptable. All manuscripts should be double-spaced throughout. Please conform to the style of recent issues of the journal. Illustrations can be used only if the cost of engraver's blocks is met through the author or his institution. Forms may be closed five weeks in advance of publication. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to Reed C. Rollins,
Gray Herbarium, 22 Divinity Avenue, Cambridge 38, Mass.

Subscriptions and orders for back issues (making all remittances payable to RHODORA) should be sent to Albert F. Hill, Botanical Museum, Oxford Street, Cambridge 38, Mass.

Second Class Postage Paid at Boston, Mass.

Printed by
THE LEXINGTON PRESS, INC.
Lexington, Mass.

Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Vol. 63 June, 1961 No. 750

SYNOPSIS OF THE GENUS XANTHOCEPHALUM (COMPOSITAE)

OTTO T. SOLBRIG[1]

Xanthocephalum is a small genus of homochromous *Compositae-Astereae*. It is composed of stout annuals or short-lived perennials which are characterized by a reduced pappus, glutinous campanulate or hemispheric involucre, and conspicuous yellow-rayed heads with a relatively large number of flowers, both ligulate and tubular. The genus is found in central and northern Mexico, from the state of Puebla to the United States border and in southern Arizona, New Mexico and Texas.

The present investigation was prompted by the lack of any taxonomic work covering the species in their entirety. Its aim is therefore only to delimit somewhat precisely the taxa and to present a key to the species, and is not intended as a monograph. In a previous paper (Solbrig, 1960), the characters of *Xanthocephalum* and related genera were discussed. The present investigation supplements that work by correcting information presented there and by adding some new data on generic characters.

Material from the Gray Herbarium (GH) of Harvard University, the U. S. National Herbarium (US), and the herbaria of the University of California at Berkeley (UC) and the University of Michigan (MICH) was examined. In addition, type material from these herbaria and the Royal Botanical Gardens, Kew (K) was examined. To the direc-

[1] I am very grateful to Dr. Carroll Wood for reading the manuscript and making valuable suggestions.

tors and curators of all these institutions I am very grateful for making the material in their custody available.

HISTORY OF THE GENUS

Xanthocephalum was described by Willdenow in 1807, apparently based on material collected and described by Humboldt. No specific name was given in the original description. Kunth (Humboldt, Bonpland and Kunth, 1820) referred the species *X. centauroides* (without a description) to Willdenow's description, stating that he had not seen any material of it. This is, to my knowledge, the first specific epithet ascribed to *Xanthocephalum*, and may therefore be considered the type species. In the same work, Kunth described the genus *Xanthocoma* with the species *X. humile*. He also redescribed *Xanthocephalum centauroides* as *Pyrethrum Bonplandianum*. Lessing (1832) realized the true identity of *Pyrethrum Bonplandianum* Kunth, but not that of *Xanthocoma humile* which he maintained. De Candolle (1836, 1837) also accepted both genera, describing a new species of *Xanthocephalum*, *X. suffruticosum*. He failed to realize the true identity of *Pyrethrum Bonplandianum*, with the result that he coined the name *Xanthocephalum Bonplandianum*, and redescribed under *X. suffruticosum*, what is in reality, *X. centauroides*. Another new species of *Xanthocephalum* is described by him as *Keerlia linearifolia*. In 1852 Asa Gray transferred this last to the genus *Gutierrezia* in which, the epithet *linearifolia* being preoccupied, he coined the combination *Gutierrezia Alamani*. A year later, Gray described two more species of *Xanthocephalum* under *Gutierrezia: G. gymnospermoides* and *G. Wrightii*. In 1857 Regel, realizing that *Gutierrezia gymnospermoides* is not a true *Gutierrezia*, but apparently unaware of the existence of *Xanthocephalum*, described *Guenthera viscosa*, based on *Gutierrezia gymnospermoides* Gray. The following year, still another name, *Grindeliopsis* (invalid according to the present rules) was created for the same plant by Schultz Bipontinus. George Bentham (Bentham and Hooker, 1873) recognized the synonymy of all these generic names. In 1880, Asa Gray accepted Bentham's concept and described still another species, *Xanthocephalum sericocarpum*. Hemsley (1881-82) in *Biology of Central America* attempted the first and only revision of the genus. He also described in

FIG. 1. Distribution of the species of *Xanthocephalum*. Each symbol represents a locality, regardless the number of collections. Above, for Benthamianus, read Benthamianum.

that work two new species. Since then new species have been described by Fernald (1901) and Robinson (1893). Thus in all, four generic names and over fifteen species have been ascribed to *Xanthocephalum*.

MORPHOLOGICAL AND CYTOLOGICAL CHARACTERS

A detailed comparative account of the principal morphological features has been presented elsewhere (Solbrig, 1960). It should be added that, contrary to what was stated then, not all species of *Xanthocephalum* are annuals, a few being short-lived perennials. Nevertheless, none are globose shrubs like species of *Gutierrezia* and *Amphipappus*. Likewise, the blooming period is not strictly fall (that is the period between September 21 and December 21), but late summer and fall. This applies to all the genera indicated in that work as fall bloomers. Nevertheless no species blooms normally in the spring, as is the case with *Amphipappus*. It may be added that most species of *Xanthocephalum* seem to be restricted to the mountainous areas of central and northwestern Mexico and border areas of the United States, usually in dry pine forests. Two species are adapted to marshy habitats in central Mexico (fig. 1).

Xanthocephalum gymnospermoides, with six pairs of chromosomes, was the only species of the genus known cytologically (Raven, Solbrig, Kyhos and Snow, 1960). Since then I have had the opportunity to get a count on material of *Xanthocephalum Wrightii* from near Alpine, Arizona (*Solbrig 3218*, GH) which had only four pairs of chromosomes. In addition Dr. B. L. Turner[2] has also found n=4 for *Xanthocephalum linearifolium*, from La Cima Station, Distrito Federal, México (*Beaman 3653*, MSC). This eliminates one of the generic differences between *Xanthocephalum and Gutierrezia* (which has x=4). It is interesting to note that *Xanthocephalum Wrightii* is the species morphologically closest to *Gutierrezia*. Nevertheless, these results do not require a reassessment of the status of *Xanthocephalum* as a genus as outlined elsewhere (Solbrig, 1960).

[2]I am grateful to Dr. Turner for permission to use this hitherto unpublished count.

TAXONOMIC TREATMENT

Xanthocephalum Willd. Ges. Naturf. Fr. Berlin. Mag. 1: 140. 1807. *Xanthocoma* HBK. Nov. Gen. et Sp. Plant. 4: 310. 1820. (Type: *X. humile* = *Xanthocephalum humile*). *Guenthera* Regel, Gartenflora 7: 44. 1858. (Type: *G. viscosa* = *Xanthocephalum gymnospermoides*). *Grindeliopsis* Sch. Bip. Bonplandia 6: 356. 1858 (Nomen nudum).

Stout annuals or short-lived perennials, erect, glabrous to tomentose, often glandular-pubescent or resinous. Leaves petiolate, the cauline sometimes sessile, alternate, thin to subcoriaceous, linear-lanceolate to lanceolate, simple, entire, or divided. Heads solitary at the end of the branchlets, usually cymosely arranged, peduncles of variable length. Heads campanulate or hemispheric, involucral bracts in two to many rows, imbricate, yellowish, reddish or green, with or without green midribs and tips. Flowers pale to golden yellow, ligules usually more than twice the length of the involucre, numerous; tubular flowers campanulate, with a short tube and usually an expanded throat and five small triangular lobes; stamens five, tailless; styles of tubular flowers with triangular or elongate tips with collecting hairs occupying varying degrees of the outer surface of the stylar branches and with the stigmatic papillae always occupying the margins of the lower halves of the stylar branches below the collecting hairs; styles of ligulate flowers only papillate; pappus usually reduced to a low crown less than 0.5 mm. long, infrequently formed by short, irregular squamellae; achenes turbinate, swollen or flat, glabrous or tomentose.

TYPE SPECIES: *Xanthocephalum centauroides* Willd.

KEY TO THE SPECIES

A. Achenes white-hairy at maturity. Receptacle conical.....6. *X. sericocarpum.*

A. Achenes glabrous or sparsely pubescent. Receptacle flat or convex, not conical.

B. Plants 5-10 cm. high with entire leaves with entire margins.....2. *X. humile.*

B. Plants more than 20 cm. high, or if less, then with serrate-dentate leaves.

C. Leaves usually pinnatifid, sometimes serrulate, if serrulate then not glandular dotted.....1. *X. centauroides.*

C. Leaves entire or dentate, occasionally serrated.

D. Stems longitudinally grooved, without conspicuous glandular hairs.

E. Heads 1.5 cm. or more in diameter, ligules 15 mm. or more in length, leaves broad (5-10 mm.).....8. *X. megalocephalum.*

E. Heads less than 1.5 cm. in diameter, ligules not more than 15 mm. in length, leaves narrow or broad.
F. Leaves linear, 1-2 mm. broad, ligules 1-2 mm. wide. Plants from an annual rootstock, usually profusely branched.....5. *X. Wrightii.*
F. Leaves lanceolate more than 2 mm. broad, ligules 3 mm. wide. Plants from a perennial rootstock, usually little branched.....3. *X. linearifolium.*
D. Stems round, with conspicuous glandular hairs.
G. Involucres glabrous-resinous, leaves usually entire, but sometimes with dentate or serrated margins.....4. *X. gymnospermoides.*
G. Involucres glandular-pubescent, leaves always dentate-serrate margined.....7. *X. Benthamianum.*

1. **Xanthocephalum centauroides** Willd. ex HBK. Nov. Gen. et Sp. 4: 312. 1820.

Pyrethrum Bonplandianum HBK. Nov. Gen. et Sp. 4: 300. 1820; *Xanthocephalum Bonplandianum* (HBK.) DC. Prodr. 6: 44. 1837. Based upon *Humboldt & Bonpland* "in Mexici locis altis prope Valladolid de Mechoacan". *Xanthocephalum suffruticosum* DC. Prodr. 6: 44. 1837. Based upon *Berlandier 538*, "circa urbem Mexici" (G!). *Grindelia coronopifolia* Lehm. Linnaea 5: 376. 1830. Based upon cultivated material (presumably living) of the Botanical Garden in Hamburg. *Xanthocoma dentata* Schauer, Linnaea 19: 723. 1847; *Xanthocephalum dentatum* (Schauer) Hemsley, Biol. Centr.-Am. Bot. 2: 111. 1881. Based upon *Aschenborn 10* "Mexico".

Annual or short-lived perennial, 15-50 cm. high. Shoots usually several from base, racemose branched, grayish-green or green, glabrous. Leaves lanceolate, 3-8 cm. long, 1-5 mm. wide, glabrous, borders usually serrate or toothed, sometimes almost entire, the teeth distinct and spaced. Heads cymosely arranged at the end of branchlets, involucres campanulate or hemispheric, 4-11 mm. wide, 3-6 mm. high; involucral bracts numerous, lanceolate, appressed, glabrous, arranged in 2-5 loose series, with green upper portions. Ligulate flowers 20-40, ligules 4-6 mm. long, 1-3 mm. wide, tube ca. 2 mm. long; tubular flowers numerous 40-60, with a very narrow tube expanding into an upper throat at least three times as wide; stylar branches with triangular tips covered with collecting hairs, and a long stigmatic portion. Pappus minute, achenes glabrous, terete or slightly appressed.

TYPE LOCALITY: Not known. (see under history of the genus).

DISTRIBUTION: Central México, from México City to San Luis Potosí and Durango.

MATERIAL STUDIED: **México.** DISTRITO FEDERAL. México City, *Orcutt 4112* (GH), *Pringle 6441* (GH, MICH, UC, US); près México, *Bourgeau 369* (GH, US); Valle de México, *Schmitz s. n.* (GH), *Schaffner 207* (GH); no loc., *Ghiesbreght 118* (GH). DURANGO. City of Durango and Vicinity, *E. Palmer 265* (GH, MICH, UC, US), *501* (GH, UC, US). SAN LUIS POTOSÍ. San Luis Potosí *Schaffner 312* (GH). VERA CRUZ. Mt. Orizaba, Maltrata, *Seaton 10* (GH, US).

2. Xanthocephalum humile (HBK.) Sch. Bip. ex Hemsley, Biol. Centr.-Am. Bot. 2: 111. 1881.

Xanthocoma humile HBK. Nov. Gen. et Sp. 4: 311. 1820; *Chrysanthemum humile* (HBK.) Spreng., Linn. Syst. ed. 16, 3: 584. 1826.

Annual or short-lived perennial herb 10-15 cm. high. Shoots few, unbranched from the base, brownish gray, glabrous and slightly fistulose. Leaves lanceolate, 0.5-5.0 cm. long, 0.5-3.0 mm. wide, the lower petiolate and large, forming a loose basal rosette, the upper sessile and short, glabrous, acute, entire. Heads solitary at the end of the branches, involucre hemispheric, 5-10 mm. wide, 3-6 mm. high; involucral bracts lanceolate, glabrous, arranged in two loose series, with midrib and tips green. Ligulate flowers 20-30, ligule 4-6 mm. long, tube 1-2 mm. long; tubular flowers 30-50, not more than twice the number of ligulate flowers, the corolla with a narrow tube app. 2 mm. in length provided with a few trichomes, broadening into an upper throat of same length and app. twice as broad; stigmatic branches of styles of tubular flowers with a triangular tip covered with collecting hairs and a lower papillate region; pappus a very short tube; achenes terete or prismatic, glabrous.

ILLUSTRATION: HBK. Nov. Gen. et Sp. 4: t. 412, 1820.

TYPE LOCALITY: "Crescit locis humidis Regni Mexicani, inter pagum Carpio et locum Sancti Christophori, Alt. 1180 hex. . ." *(Humboldt).* (Not seen).

DISTRIBUTION: Central México. Known from a few localities in northern Puebla, México City and San Luis Potosí.

MATERIAL STUDIED: **México.** DISTRITO FEDERAL. Valle de México, *Schmitz 43* (GH), *Pringle 3202* (GH, UC, US), *Pringle 7422* (US); México, *Bourgeau 163* (GH, US). PUEBLA. Near Lago Salado, 253 km. e. of México City, *Weaver 865* (GH, US). SAN LUIS POTOSÍ. San Luis Potosí, *C. Parry and E. Palmer 525* (GH, US).

3. Xanthocephalum linearifolium (DC.) Greenman, Publ. Field Mus. Nat. Hist. Bot. 2: 345. 1912.

Keerlia linearifolia DC. Prodr. 5: 310. 1836; *Gutierrezia Alamani* Gray, Pl. Wright. 1: 91. 1852; *Xanthocephalum Alamani* (Gray) Benth. & Hook. ex Hemsley, Biol. Centr.-Am. Bot. 2: 109. 1881.

Rhizomatous perennial 10-35 cm. high, forming a dense mat. Shoots sparsely branched, greenish, somewhat fistulous, glabrous. Leaves 2-8 cm. long, 2-8 mm. wide, lanceolate-spathulate, acute, glabrous, the margins entire, sessile or with a poorly defined petiole. Heads solitary at the end of the branches, involucre hemispheric, 6-15 mm. wide, 4-6 mm. high; involucral bracts broadly lance-triangular, glabrous, glutinous, appressed in 2 or 3 loose series, with green tips. Ray flowers few (10-20), conspicuous, ligule 5-10 mm. long, 2-4 mm. wide, tube 2-3 mm. long; tubular flowers numerous (60-80), about 5 times more than ligulate flowers, corollas broadly campanulate, 3-4 mm. high; appendages of the style covered almost entirely by collecting hairs, the papillate region short; pappus variable, usually a short crown or formed by minute paleae; achenes turbinate, 1-2 mm. long, glabrous or pubescent, but never densely silky-pubescent.

TYPE LOCALITY: ". . . in Mexico . . ." *(Alaman)*. (Not seen).

DISTRIBUTION: Restricted to the valleys of México City and Toluca and neighboring areas.

MATERIAL STUDIED: **México.** DISTRITO FEDERAL. Cima Station, *Pringle 11613* (GH, MICH, US), *Moore 3439* (GH, US), *Orcutt 3784* (GH, US), *Lyonnet 841* (US), *Harshberger 120* (GH); 38 km. s. of México, *Hitchcock & Stanford 7039* (UC, US); 40 km. s. of México City, *Schoonberger 8562* (MICH); Valley of México, *Reiche 1* (US), *s. n.* (US). STATE OF MÉXICO. 12 mi. s. of Tlalpan, *W. E. & Margaret Manning 531040* (GH); calcareous bluffs, valley of Toluca, *Pringle 4195* (GH, MICH, UC, US); Las Cruces, *Hinton 1036* (US); 30 mi. w. of Toluca, *Hitchcock & Stanford 7217* (US).

4. **Xanthocephalum gymnospermoides** (Gray) Benth. & Hook. ex Rothrock, in Wheeler, U. S. Geogr. Survey W. of 100th meridian 6: 140. 1878. (Incorrectly ascribed to Benth. & Hook. Gen. Pl. 2: 249. 1873).

Gutierrezia gymnospermoides Gray, Pl. Wright. 2: 78. 1853. *Guenthera viscosa* Regel, Gartenflora 7: 44. 1858. (based on *Gutierrezia gymnospermoides*). *Grindeliopsis gymnospermoides* Sch. Bip. Bonplandia 6: 356. 1858 (nomen nudum).

Stout annual up to two meters tall. Stem with brownish-green bark, little branched at the base, somewhat more towards the top. Leaves lanceolate, of variable size, about 0.5-3.0 cm. broad and 3-15 cm. long,

glabrous, the margins entire, toothed or slightly serrated, acute, the upper surface shiny and somewhat glutinous, the midrib prominent on lower surface, sometimes somewhat reddish in color. Branchlets, flowering shoots and pedicels often reddish, with prominent capitate glands in varying density. Heads numerous, cymosely arranged in crowded groups at the end of the branchlets. Involucre campanulate, glutinous, 3-7 mm. in diameter and 3-6 mm. in height; involucral bracts numerous, arranged in two loose series, glabrous, glutinous, tightly appressed, usually with green midrib and tips, the ends usually spreading. Receptacle flat or slightly convex, alveolate. Ligulate flowers 50-70, yellow, ligules 2-4 mm. in length, 1-1.5 mm. wide, about the same length as the filiform tube; tubular flowers 150-200, two to three times as many as ligulate flowers, corolla about 4 mm. long, with a narrow tube and expanded throat; style with collecting hairs restricted to the short triangular tips. Pappus variable, sometimes a low crown, sometimes a few irregular awns up to half as long as the tubular corolla. Achenes terete, glabrous or slightly pubescent, 1-2 mm. long.

TYPE LOCALITY: "Low banks of the San Pedro, Sonora (now Arizona)" *Wright* (GH!).

DISTRIBUTION: Along the mountains, northwestern México from Durango to the Arizona border; area of the Huachuca Mts. in Arizona, and Davis Mts. in Texas.

MATERIAL STUDIED: **México.** CHIHUAHUA. Prezón Ortega, *Shreve 8894* (US), *I. M. Johnston 7935* (GH, US); Majalca, *LeSueur, Mex-242* (GH), *White 2378* (GH, MICH); Rio Sta. Maria, *Thurber 747* (GH); between Casas Grandes and Sabinal, *E. W. Nelson 6381* (US), *6379* (GH, US); near Colonia Juárez, *E. W. Nelson 6321* (GH, US); 40 mi. from Guadalupe y Calvo, *E. W. Nelson 4815* (GH, US); Memelichi, Rio Mayo, *Gentry 2736* (GH, UC, US); Loreto, Rio Mayo, *Gentry 2573* (GH, UC, US); s.w. Chihuahua, *E. Palmer 439* (GH, US); near Parral, *Goldman 127* (GH, US). DURANGO. 5 mi. s.w. of Guadalupe Victoria, *Gentry 8412* (GH, MICH, UC); El Salto to Pueblo Nuevo, *Maysilles 7752* (MICH); Otinapa, *E. Palmer 455* (US). SONORA. Cananea, *Pennelly 7* (UC). **United States.** ARIZONA. Cochise Co.: San Pedro River, *Smart 404* (US); W. of Huachuca Mts., *Shreve 7728* (MICH); Ft. Huachuca, *Patzky 38* (US); Ramsey Canyon, Huachuca Mts., *Hood 181* (US); Huachuca Mts., *M. E. Jones s. n.* (US), *Lemmon 2738* (GH, UC, US); near Ft. Huachuca, *Wilcox 38* (US). Pima Co.: Silver Lake, near Tucson, *Toumey 608* (US); Sacaton, *G. J. Harrison 6016* (GH). Santa Cruz Co.: Alkaline plains, *Pringle s. n.* (GH, US); Patagonia Mts., *Kearney & Peebles 14832* (US); near Nogales, *Peebles & Harrison 4726* (US); Nogales, *Hood 174* (US); South Arizona, *Rothrock 667* (GH, US). TEXAS. Davis Co.: Ft. Davis, *Reed 866* (US); Davis Mts., *Young s. n.* (UC).

NOTE: Some of the specimens from Chihuahua *(Gentry 2736, 2573)* were devoid of ligulate flowers, although undistinguishable from normal ligulate plants in all other respects. This rayless form which apparently is geographically isolated might deserve varietal status. Nevertheless, since in some Compositae raylessness has proved to be determined by a single gene, it is felt that before giving formal recognition to this form, more work, especially of an experimental nature, is needed.

5. **Xanthocephalum Wrightii** (Gray) Gray, Proc. Am. Acad. 8: 632. 1873.

Gutierrezia Wrightii Gray, Pl. Wright. 2: 78. 1853.

Stout annual not more than 75-100 cm. high. Shoots striate, often branching from the base. Leaves linear-lanceolate, usually 4-6 cm. in length, occasionally up to 10 cm. long, not more than 3-5 mm. wide, surface glabrous, the margins entire, sometimes short-ciliate. A loose basal rosette of leaves is present in young plants, but absent in more mature ones. Heads disposed in loose, cymose arrangements. Involucre hemispheric, 4-10 mm. wide, 4-6 mm. high; involucral bracts imbricated, appressed, glutinous, with a green tip, sometimes slightly spreading. Ray flowers few (14-20), with a long and showy ligule 5-7 mm. long, 2-3 mm. wide and a short tube, 2-3 mm. long; tubular corollas about four times more numerous than the ligulate ones (50-60), with a broad throat and short tube; style of tubular flowers with long subulate appendages covered with collecting hairs and with only a short lower papillate portion; pappus a low crown; achenes terete, glabrous, somewhat striate, 1-2 mm. long.

TYPE LOCALITY: "between Barbacomori and Santa Cruz, Sonora" *Wright 1177* (GH!).

DISTRIBUTION: Northwestern México (Chihuahua, Durango, and Sonora) and southwestern United States (Arizona and New Mexico), in moist places at mid-altitudes in the mountains.

MATERIAL STUDIED: **México.** CHIHUAHUA. Cañon de San Diego, *Lumholtz 765* (GH, US); near Colonia Garcia, *E. W. Nelson 6203 a* (GH, US), *Townsend & Barber 304* (GH, UC, US); 5 mi. S. of Garcia, *Leopold 234* (UC); near Chichupa, *Townsend & Barber 421* (GH, UC, US); lake near Chichupa, *LeSueur 1370* (GH); Chuhuichupa, *LeSueur 992* (GH); Sierra Madre, *E. W. Nelson 6307* (GH, US), *Pringle 1631* (UC); foothills, base of Sierra Madre, *Pringle 1280* (GH, MICH, US), *1629* (UC); los Cascarones, Rio Mayo, *Gentry 2681* (GH, UC, US); Canelo, Rio Mayo, *Gentry 2008* (GH, UC, US); Majalca, *Le Sueur, Mex-30* (GH, UC); 38.2 mi. w. of viejas Casas Grandes, *Tucker 2489* (UC, US). DURANGO. City of Durango, *E. Palmer 823* (UC, US), *E. W. Nelson 4623* (US); 34 mi. w. of Ciudad Durango, *Maysilles 7547* (US). SONORA. El Rancho del Roble, *White 4261* (GH, MICH), *4247* (MICH);

between Las Tierritas and El Tigre, *Phillips 684* (GH, MICH), *White 3451* (GH, MICH); Las Tierritas del Temblor, *White 3410* (GH, MICH); Barbacomori to Sta. Cruz, *Thurber 1007* (GH); El Billito, *White 4834* (MICH). **United States.** ARIZONA. Apache Co.: 8 mi. n. of Hannagan Meadow, White Mts., *Kearney & Peebles 12428* (GH); White Mts. *Gould & Robinson 4978* (UC); Mc Nary, *Whitehead 1633* (MICH); Buffalo Junction, *Solbrig 3218* (GH), *Parker & McClintock 7643* (UC, US). Cochise Co.: Mule Mts., *Harrison & Kearney 6236* (GH); Rucker Canyon, Chiricahua Mts., *Gould & Haskell 4603* (GH); Chiricahua Mts., *Lemmon s.n.* (UC); Carr Peak, Huachuca Mts., *Goodding 869* (GH, US); upper Miller Canyon, Huachuca Mts., *Goodding 420* (GH); Reef Mine, Huachuca Mts., *Darrow, Phillips, Gould & Pultz 1418* (GH); Ramsey Canyon, Huachuca Mts., *Shreve 5038* (MICH), *M. E. Jones s. n.* (GH, UC); Huachuca Mts., *Peebles, Harrison & Kearney 3387* (US), *Harrison & Kearney 5777* (US), *Holzner 2025* (US), *Shreve 5074* (UC), *Gould, Darrow, Phillips & Pultz 2486* (UC), *Gould & Haskell 3375* (UC); Santa Cruz Co.: Wrighton Peak, Santa Rita Mts., *Clark 12310* (GH); Santa Rita Mts., *Griffiths & Thornber 169* (US); near Washington, Patagonia Mts., *Kearney & Peebles 10107* (MICH, US); Roberts Ranch, *Wooton s. n.* (US). NEW MEXICO. Catron Co.: Mogollon Mts., *Wooton s. n.* (US), *Saunders s. n.* (UC), *Metcalfe 458* (US); Grant Co.: Pinos Altos Mts., *Greene 200* (GH); Black Range, *Pilsbury s. n.* (US); Black Mts., *Archer 358* (MICH); Silver City, *Holzinger s. n.* (US); Head of Cow Creek, *Eggleston 16030* (GH); Iron Creek, *Metcalfe 1481* (GH, UC, US).

6. **Xanthocephalum sericocarpum** Gray, Proc. Am. Acad. 15: 31. 1880.

Xanthocephalum conoideum Hemsley, Biol. Centr.-Am. Bot. 2: 110. 1881. Based upon *Coulter 299*, "Real del Monte to Zacatecas" [Mexico] (K) (Isotype GH!).

Stout annual 30-50 cm. tall, usually branching profusely from the base. Shoots greenish, fistulous, less than 5 mm. in diameter at the base and not more than 1-2 mm. at the upper ends, glabrous, often with minute bracteoles. Leaves linear, 3 to 5 cm. long, 1-3 mm. wide, glabrous, acute, border entire, petiole very short or absent. Heads solitary at the end of branchlets, sometimes forming a loose cyme. Involucres hemispheric, 6-12 mm. wide, 5-7 mm. high, involucral bracts broadly lanceolate, acute, tightly appressed in two loose rows, with green tips and midribs; receptacle conical, grooved; ligulate flowers 25-40, ligules 6-12 mm. long, 2-3 mm. wide, tube 2-3 mm. long; tubular flowers 100-150, about four times as many as ligulate flowers, the tube broadly campanulate, 2-3 mm. long; styles of tubular flowers with the distal halves of the stigmatic portions covered with collecting hairs, the lower half papillate; pappus a relatively well

developed crown, 0.5 to 1.5 mm. long; achenes terete, silky pubescent at maturity.

TYPE LOCALITY: "Near San Luis Potosi . . ." *Parry and Palmer 369* (GH!).

DISTRIBUTION: Northern México, from Jalisco and Querétaro northward.

MATERIAL STUDIED: **México.** CHIHUAHUA. Pine plains, base of Sierra Madre, *Pringle 1278* (GH, MICH, US); Namaquipa, *LeSueur, Mex-337* (GH); near Balleza, *Goldman 141* (GH, US); 12 mi. w. of San Antonio, *C. Muller 3380* (GH, MICH, US); southwestern Chihuahua, *E. Palmer 412* (GH, US); Mapula Mts., *Pringle 1150* (GH); 34 mi. s. of Parral, *Waterfall 12528* (MICH). DURANGO. City of Durango and vicinity, *E. Palmer 823* (GH), *143* (GH, MICH, UC, US); Sandía Station, *Pringle 13580* (GH, MICH, US); 34 mi. w. of Durango, *Maysilles 7547* (MICH), *7689* (MICH, US). JALISCO. Road between Huajnilla and Mesquite, *Rose 2560* (US). QUERÉTARO. Cazadero Station, *Pringle 10066* (GH, UC, US); 15 mi. se. of San Juan del Rio, *Waterfall 13987* (US). SAN LUIS POTOSÍ. San Luis Potosí, *Schaffner 744* (US).

7. **Xanthocephalum Benthamianum** Hemsley, Biol. Centr.-Am. Bot. 2: 110. 1881.

Stout annual 20-50 cm. tall with little or no branching from the base, and only slightly branching above. Stems greenish, greenish brown or reddish, slightly fistulous at times, 1-3 mm. in diameter, usually covered with capitate glands, especially in the upper portions. Leaves broadly lanceolate, 2-8 cm. long, 5-10 mm. wide, the lower shortly petiolate, the upper ones sessile, glabrous or slightly pubescent, the margins coarsely serrate. Heads solitary at the end of branchlets, sometimes arranged in loose cymes. Involucres campanulate, 8-15 mm. broad, 4-7 mm. high; involucral bracts numerous, variously covered with capitate glands, loosely arranged in several series, the upper portions green, the tip usually extended. Ligulate flowers 30-40, ligules 6-10 mm. long, tube app. 2 mm. long; tubular flowers numerous (100-200), four to six times as many as the ligulate, the very narrow tube followed by a wide throat; tips of stylar branches triangular, covered with collecting hairs, and with a large papillate region. Pappus a low crown; achenes terete, glabrous, 1-2 mm. high.

TYPE LOCALITY: "South México, Aguas Calientes" *Hartweg 110* (Isotype GH!).

DISTRIBUTION: Central México, from México City to Durango.

MATERIAL STUDIED: **México.** AGUASCALIENTES. *Hartwegg 110* (GH). DURANGO. W. of Durango, *Forber 17* (UC); 5 mi. n. of Coyotes, *Maysilles 8171* (MICH); Coyotes Hacienda, *Maysilles 7853* (MICH); 60 mi. sw. of Durango, *Maysilles 7781* (MICH); Rio Chico, *Maysilles 7656* (MICH). STATE OF MÉXICO. Del Rio, *Pringle 5336* (GH). MICHOACAN.

Patzcuaro, *Kenoyer 1690* (GH). SAN LUIS POTOSÍ. Chiefly in the region of San Luis Potosí, *C. Parry & E. Palmer 526* (GH, UC). ZACATECAS. Near Plateado, *Rose 2720* (US).

NOTE: *Xanthocephalum Benthamianum* is closely allied to *X. gymnospermoides* and might possibly be only a southern form of this last species. The serrated leaves and the glandular dotted involucres, the increased general pubescence and the more southern distribution (with a considerable overlap) of *X. Benthamianum* seem nevertheless sufficient specific distinction from a typological point of view. Only field studies and crossing experiments which are lacking at present can determine the true status of *X. Benthamianum*.

8. **Xanthocephalum megalocephalum** Fernald, Proc. Am. Acad. 36: 505. 1900.

Rhizomatous perennial 30-70 cm. high. Stems glabrous, greenish, slightly fistulous, little or not branched at the base, moderately so above. Basal rosette leaves spatulate-lanceolate when present, 10-15 cm. long, 5-10 mm. broad, petiolate, acute, glabrous. Cauline leaves sessile, lanceolate, 4-6 cm. long, 5-15 mm. broad, glabrous. Heads borne singly or in pairs at the end of branchlets; involucre hemispheric, 10-20 mm. broad, resinous, with a green tip; ligulate flowers 15-30, ligules large, 12-20 mm. long, the tube 3 mm. long; tubular flowers 80-100, about four times as many as ligulate flowers, campanulate, with a short tube and broad throat; stigmatic branches subulate, almost completely covered with collecting hairs, the stigmatic papillae restricted to the lower portion; pappus a short crown not more than half a millimeter in length. Achenes terete, 1-2 mm. long, glabrous.

TYPE LOCALITY: "Chihuahua, Mt. Mohinora" *E. W. Nelson 4890* (GH!).

DISTRIBUTION: Uncommon in northern Durango and western Chihuahua, México.

MATERIAL STUDIED: **México.** CHIHUAHUA. Near Guachichi, *Goldman 174* (GH, US); along road to Parral, near San Julián, *E. W. Nelson 4932* (GH, US); Sierra Madre, *Pringle 1630* (UC), *1279*, (GH, UC, US); mountains north of Chihuahua, *LeSueur 1377* (GH). DURANGO. State of Durango, *Ibarra Garcia 412* (US).

NOTE: This rare species shows close similarities to *X. Wrightii* and to *X. linearifolium*. Nevertheless the large heads and long ligules were sufficiently distinct to permit an easy identification of *X. megalocephalum* in the material studied. — GRAY HERBARIUM, HARVARD UNIVERSITY.

LITERATURE CITED

BENTHAM, G., AND J. D. HOOKER, 1873. Genera plantarum. Vol. 2(1), 553 pp., London.

DE CANDOLLE, A. 1836-37. Prodromus systematis naturalis. Vols. 5 and 6. Paris.

FERNALD, M. L. 1901. Some new spermatophytes from México and Central America. Proc. Am. Acad. **36**: 491-506. 1901.

GRAY, A. 1852. Plantae Wrightianae Texano- Neo-Mexicanae. 146 pp. Washington.

———. 1873. Notes on Compositae and characters of certain genera and species, etc. Proc. Am. Acad. **8**: 631-661.

HEMSLEY, W. 1881-82. Biol. Centr.-Am. Bot. **2**: 620 pp. London.

HUMBOLDT, A., A. BONPLAND AND C. KUNTH. 1820. Nova genera et species plantarum. **4**: 312 pp. Paris.

LESSING, C. E. 1832. Synopsis genera compositarum. 473 pp. Berlin.

RAVEN, P., O. T. SOLBRIG, D. KYHOS AND D. SNOW. 1960. Chromosome numbers in Compositae. I. Astereae. Am. Jour. Bot. **47**: 124-132.

REGEL, E. 1858. Im Botanischen Garten zu Petersburg geprüfte neuere and ältere Pflanzen. Gartenflora **7**: 43-52.

ROBINSON, B. L. 1893. Descriptions of new plants collected in México by C. G. Pringle in 1890 and 1891, with notes upon a few other species. Proc. Am. Acad. **27**: 165-185.

SCHULTZ BIPONTINUS, K. 1858. Neue Zierpflanzen. Bonplandia **6**: 356.

SOLBRIG, O. T. 1960. The status of the genera Amphipappus, Amphiachyris, Greenella, Gutierrezia, Gymnosperma and Xanthocephalum (Compositae). Rhodora **62**: 43-54.

WILLDENOW, C. L. 1807. Einige Bemerkungen über die Pflanzen der Klasse Syngenesia. Ges. Naturf. Fr. Berlin, Mag. **1**: 132-141.

ROOTS AND THE TAXONOMIC DIFFERENCES BETWEEN BOTRYCHIUM ONEIDENSE AND B. DISSECTUM

W. H. WAGNER, JR.[1]

Since first distinguished nearly sixty years ago, the plant here treated as *Botrychium oneidense* (Gilbert) House has been a continuous source of taxonomic disagreement. It has been interpreted as a variety of *B. multifidum* (Gmel.) Rupr. or as a variety of *B. dissectum* Spreng. (Wagner, 1960a). It was originally described as a variety of a third species, *B. ternatum* (Thunb.) Sw. Only House (1921) seems to have recognized *B. oneidense* as a distinct species; but he changed his mind just three years later, and made it a vari-

[1]This study was supported in part by a grant from the Horace H. Rackham School of the University of Michigan and in part by National Science Foundation Grant G-10846. I am indebted to Miss Virginia M. Morzenti for her careful assistance.

ety of *B. obliquum* Muhl. (1924). In general, then, we can find agreement on only one point, viz., that — whatever it is — taxon *oneidense* must be a variety of some other species. No author, at least for any length of time, seems to have thought that *B. oneidense* is truly a distinct species, or that the difficulty of placing it with one or another of the several species of which it has been made a variety might be due to that fact.

After personal observations of over sixty localities where the plants grow together in Ohio, Ontario, and Michigan, as well as fresh, living materials sent by others from southern Indiana and Maryland — a total of over 4,500 specimens of *B. dissectum* and 2,000 of *B. oneidense* — I feel convinced that these are distinct species (Wagner, 1955, 1960a). *Botrychium dissectum* is a highly variable plant, the most common and "normal" form of which is f. *obliquum* (Muhl.) Fern. The type form, *dissectum*, is often so lacerated that botanists have frequently treated it as a variety, or even as a species, distinct from taxon *obliquum*. However, I cannot find any differences between f. *dissectum* and f. *obliquum* other than those of marginal cutting, and there are numerous intermediates. In spite of the rather spectacular contrast in their appearance, I cannot treat even the extremes as more than minor forms of the same species. On the contrary, *B. multifidum*, *B. oneidense*, and *B. ternatum* each have a series of differences from one another and from *B. dissectum* that justify their interpretation as distinct species. This conclusion is substantially bolstered by the fact that all four of these species co-exist side-by-side in the same habitats in any combination, over a tremendous area of the northeastern United States (Wagner, 1960a, 1960b). The most significant point is perhaps that, in spite of overlap in practically every character that differentiates these plants, there are correlated series of central tendencies for each taxon that in totality are clearly different. These ensembles of average differences maintain themselves, wherever these plants grow together, with monotonous regularity. I do not, in fact, believe that all of the differences between them have yet been found. The present report will

PLATE 1259. Habitat forms of *Botrychium oneidense:* Top two rows, deep shade, Saginaw Co., woods along M-83, Sect. 22, R.6E, T.10N, Sept. 20, 1959, 9110. Bottom two rows, edges of cleared old fields, St. Clair Co., along Belle River, Sect. 28, T.5N, R.15E, May 12, 1957, 8393.

PLATE 1260. Habitat forms of *Botrychium dissectum:* Top two rows (91091) and bottom two rows (83941) from same localities as Plate 1259.

describe a newly uncovered contrast between two of the species that was quite unexpected and apparently completely overlooked, not only by previous workers but by the present author as well. It involves the root differences between *Botrychium oneidense* and *B. dissectum*.

In making studies of critical characters among these species, *the populations must be compared in the same habitats* (e.g., a shaded swamp; a low, wet, brushy field; or a second-growth wood). Differing localities and differing habitats produce strong modifications as shown in Plates 1259 and 1260, which will be discussed below. To ensure as precise a comparison as possible the rule followed in this study was to collect *only paired plants of the two species*. To obtain each pair, a spot was sought where a plant of *B. oneidense* grew close to a comparable (i.e., of approximately equal size) plant of *B. dissectum*. The arbitrary limit of permissible distance between them was five feet. Then the plant of *B oneidense* was dug up, along with the neighboring one of *B. dissectum*. Thus the average distance between the members of the pairs was between two and three feet. (The same rule was followed to compare other species, to be mentioned below.) The measurements of the diameters of the two largest roots of each living specimen were made 1 cm. from the stem to the nearest 0.1 mm., using calipers.

RESULTS. The habitat variation of roots in *B. oneidense* is probably fairly well represented by the data of this study, but the same cannot necessarily be said for *B. dissectum*. The reason for this is that the morphological differences found between various localities of *B. oneidense* are considerably less pronounced than those in the other species of evergreen grapeferns (*B. dissectum*, *B. multifidum*, and *B. ternatum*). *Botrychium oneidense* seems to be the least variable of the species. The reason for its lesser environmental variability seems very likely to be due to its narrower definition of habitat: it is confined almost exclusively to low, wet, acid secondary woods and swamps. The most extreme leaf forms that have been found in this species are illustrated in Plate 1259. The lower two rows are from the most exposed habitat we have yet discovered — exposed

mossy areas along the edge of a dry field bordering a woods. The upper two rows are from a very deeply shaded habitat along the edge of a swamp. Corresponding specimens of *B. dissectum* from the same habitats are shown in Pl. 1260. Much more extreme specimens are known of the latter species. The five habitats we selected in which to compare the roots of these two species are what might be called approximately average for *B. oneidense* — neither the most exposed nor the most deeply shaded.

Differences between the means in root diameter of the two taxa in the different localities turned out to vary from 0.5 to 1.0 mm., as shown in Table 1. The roots of *B. dissectum* were always larger. This difference is readily evident to the naked eye when examining the root systems of a series of freshly collected specimens that have been washed. The greater thickness of the roots of *B. dissectum* is accentuated by the fact that they tend to be dark gray-brown in the region 1-5 cm. from the stem especially, but those of *B. oneidense* are paler, more delicate, and dominantly ivory-gray. Also the roots of the latter tend to have much less

TABLE 1. Root diameters of mature plants, the two largest roots of each plant measured 1 cm. from the stem. All (except *) paired specimens in same habitat.

	B. dissectum	*B. oneidense*
1.	9218a (5 plants)	9219a (5 plants)
	2.87	2.10
2.*	9218b (9)	9219b (10)
	3.08	2.15
3.	9263 (14)	9264 (14)
	2.90	2.20
4.	9265 (19)	9266 (19)
	2.92	2.20
5.	9289 (28)	9290 (28)
	3.05	2.53
6.	9307 (18)	9309 (18)
	3.06	2.48

developed circular ridges on the roots. This is shown in the samples in Plate 1261.

An anatomical examination was made of the histological nature of these differences. Specimens fixed in formalin-

acetic-alcohol solution sectioned nicely on the freezing microtome, and were examined under the compound microscope. The roots of both species are very fleshy, composed of a large cortex of starch-filled parenchyma cells and traversed by a narrow stele, the latter only 10-15 per cent the diameter of the whole root. The root steles of both are most commonly triarch, although the tetrarch condition is frequent near the rhizome, and small roots may be diarch. The primary variation of the roots at the anatomical level seems to involve the relative development of the cortex and the modification of the superficial layers. A thin-walled corky tissue

PLATE 1261. Root systems of Botrychium: Three plants on left, 9264, *B. oneidense;* three on right, 9263, *B. dissectum.* (Photographed on frosted glass plate, with light from above and below).

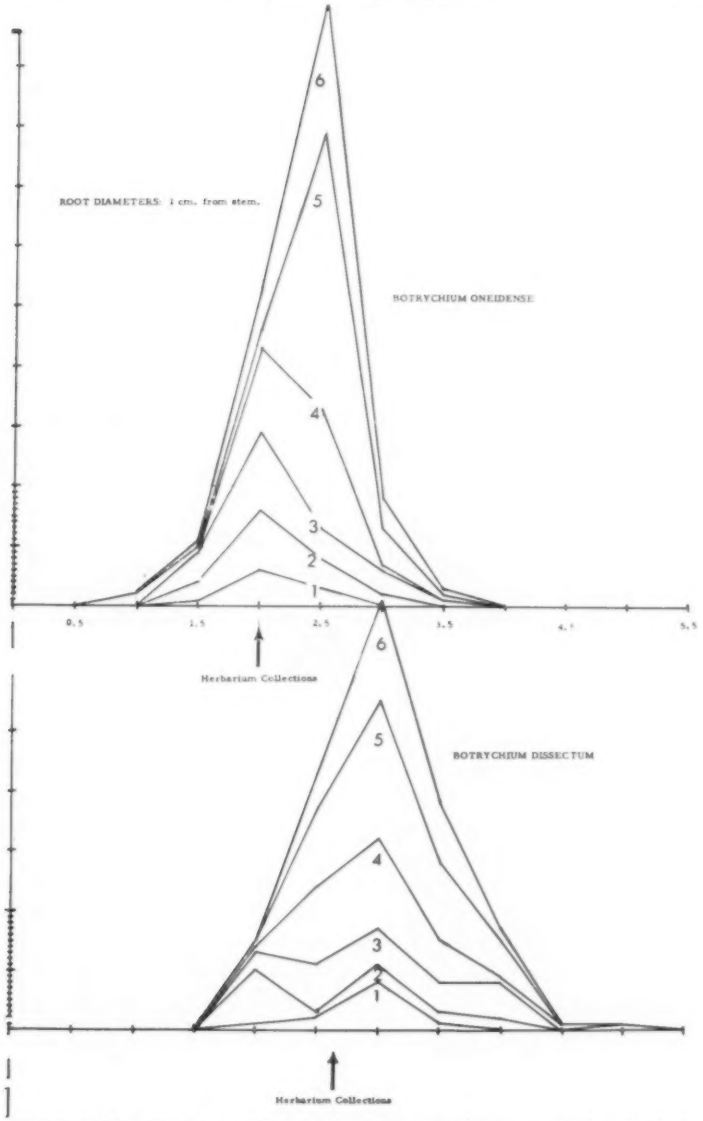

FIGURE 1. Root diameters of Botrychium. Curve numbers correspond to Table 1. Vertical scale represents number of individuals.

forms in a varying number of layers from a cambium in the outer cortex, and this tissue, comprising dead, brown-walled cells, is responsible for the darker color of the roots of *Botrychium dissectum*. The same development is found in *B. oneidense*, but its extent is less, and thus the roots appear much paler on the average and have smoother surfaces. The development of the root periderm is associated with the formation of circular ridges, these more strongly developed in *B. dissectum* but only weakly developed in all but the most robust roots of *B. oneidense*.

The differences between *B. dissectum* and the other species of evergreen grapeferns, *B. multifidum* and *B. ternatum*, proved to be negligible or inconsistent. In drier field habitats, *B. multifidum* exceeded the associated *B. dissectum* in root diameter, but in very damp habitats (two localities, one at the edge of a bog, the other in low swampy woods) it tended to have narrower roots than *B. dissectum*. *Botrychium ternatum* in three localities had roots the same thickness or somewhat more slender than those of *B. dissectum* growing with it. In general, the roots of *B. multifidum* and *B. ternatum* are more like those of *B. dissectum*; only *B. oneidense* showed a constant average difference, so far as our studies have been able to show.

In order to test whether the difference in root diameter between *B. dissectum* and *B. oneidense* would also be shown in random herbarium collections, 18 specimens each of the two species were measured from the United States National Herbarium. The results showed an average of 2.6 mm. in diameter in the former, and 2.0 mm. in the latter, as measured 1 cm. from the stem. A remeasurement of dried materials that have been compared in the living state first shows that there is almost exactly 20 per cent reduction in thickness. The original differences between species will thus remain in the dry state but on a somewhat smaller scale. According to this contraction of dried material, the National Herbarium samples would have averaged in the living state 3.1 mm. in diameter for *B. dissectum* and 2.4 for *B. oneidense*. These values compare favorably with those in Table 1.

DISCUSSION. Although this report is based upon a sample of 187 plants from only 5 habitats, the methods used seem to be sufficiently reliable to say that the average difference we found is a valid one. The fact that a random collection of herbarium sheets gave essentially the same results is an indication that the root differences between *B. dissectum* and *B. oneidense* are probably characteristic of the two species over their range.

One of the reasons that special care has been taken to assure that the differences between the roots are not environmentally induced ones is that there is some reason to believe that several of the previously accepted "differences"

TABLE 2. Summary of average differences of *B. oneidense* and *B. dissectum*.

	B. oneidense	*B. dissectum*
Habitat:	Mainly uniform: low, wet, acid secondary woods and swamps; local and rare in most of its area.	Diverse: open fields, brushy meadows, dry woods, wet woods, swamps; ubiquitous and common in much of its area.
Range:	Narrow: New Brunswick and Wisc. S. to Indiana and Maryland; and to North Carolina and Tennessee in the mountains.	Wide: Nova Scotia and Minnesota S. to Mexico and Jamaica.
Leaf Blade:	Segments few, large, rounded, with nearly entire to shallowly denticulate margins. Mature surfaces duller, smoother (less "veiny").	Segments numerous, smaller, pointed, with variable margins denticulate to very deeply and coarsely lacerate. Mature surfaces shiny, "veiny."
Pigmentation:	Unfolding leaves in spring lime green; late summer mature blade axes with av. 3-15 per cent pigmentation below; midwinter laminae mostly green where well exposed.	Unfolding leaves in spring reddish; late summer mature blade axes with av. 10-40 per cent pigment beneath; midwinter laminae bronze where well exposed.
Periodicity:	Vernation beginning in May, the new leaf averaging twice as tall during vernation stages; maturation of sporangia in last half of September.	Vernation beginning in early June, the new leaf averaging one-half as tall during vernation stages; maturation of sporangia in October.
Roots:	Root diameter 1 cm. from stem av. 2.5 mm. alive, 2.0 dried; circular ridges sparse in proximal 1-5 cm.; color dominantly ivory-gray to tan, only occasional large roots completely dark in basal 1-5 cm.	Root diameter 1 cm. from stem av. 3.0 mm. alive, 2.5 mm. dried; circular ridges well developed in proximal 1-5 cm.; color dominantly dark gray-brown in proximal 1-5 cm.

between these species are actually based upon habitat modifications. For example, we have found no evidence that *B. oneidense* has a distinctively "thin texture of the blade" when growing with *B. dissectum* (Wagner, 1960b, table 4, p. 318). Likewise, we have found no evidence of a "marked tendency toward lower fertility": indeed, when growing sympatrically in the habitats, the two species are very much alike (Wagner, 1961). We examined the spores to find differences but they too are similar.

However, there are a number of real average differences between these plants. It is, of course, possible that one or a few important genes could somehow control all of the differences, but this seems unlikely because the characters involved are so diverse. The differences lie in six categories (listed in Table 2). It is probable that many of the details of contrasts within several of the categories are inter-related and are aspects of the same thing: for example, the three contrasts under "roots" are probably all correlated. Those under periodicity, under pigmentation, and under leaf structure, may be also — but this is questionable. For example, the size and the shape of segments must surely be under different genetic control, judging from these characters in the other species. Therefore, the best statement of the differences between these two species, *B. oneidense* and *B. dissectum*, that we can make (including here the new root characters, as well as those studied previously) is as follows: they are sympatric species in northeastern North America, the range of one *(B. dissectum)* completely overlapping the other *(B. oneidense)*, and they differ in the central tendencies of differences in six known categories: (1) Habitat; (2) Range; (3) Leaf blade structure; (4) Pigmentation; (5) Periodicity; and (6) Root size and development.

VOUCHER SPECIMENS: (All Michigan field collections). Wayne Co., junct. Flat Rock Rd. and Expressway, R.9E, T.3S, Sect. 19, May 20, 1960, 9218a (Dissectum), 9219a (Oneidense), 9218b and 9219b unpaired in same habitat. Monroe Co., woods W. side of Secor Rd., 0.4 mi. s. of Todd Rd., R.7E, T.8S, Sect. 30, August 4, 1960, 9263 (D), 9264 (O). Monroe Co., S.W. corner of Nolan and Exeter Rd.,

R.8E, T.5S, Sect. 24, August 4, 1960, 9265 (D), 9266 (O). Saginaw Co., Fordney R., N. of Brady Rd., Sect. 11, R.2E, T.9N, Aug. 13, 1960, 9289 (D), 9290 (O). St. Clair Co.: N. side of Rt. 21, 0.4 mi. W. of Beach Rd., Sect. 6, R.17E, T.6N, August 23, 1960, 9307 (D), 9309 (O). — UNIVERSITY OF MICHIGAN, ANN ARBOR.

LITERATURE CITED

CLAUSEN, ROBERT T. 1944. On the status of Botrychium dissectum var. oneidense. Amer. Fern Jour. **34**: 55-60.

HOUSE, HOMER D. 1921. Nomenclatorial notes on certain American plants. Amer. Midl. Nat. **7**: 126-135.

———. 1924. Annotated list of the ferns and flowering plants of New York State. New York State Mus. Bull. no. 254.

WAGNER, W. H., JR. 1955. Cytotaxonomic observations on North American ferns. Rhodora **57**: 219-240.

———. 1960a. Evergreen grapeferns and the meanings of infraspecific categories as used in North American Peeridophytes. Amer. Fern Jour. **50**: 32-45.

———. 1960b. Periodicity and pigmentation in Botrychium subg. Sceptridium in the northeastern United States. Torrey Club Bull. **87**: 303-325.

———. 1961. On the relative development of fertile segments in Botrychium dissectum and B. oneidense. Amer. Fern Journ. (in press).

TWO NEW ORCHID RECORDS FOR ONTARIO. — While orchid hunting last year, I met Mrs. J. C. Higgins of Komoka, Ont., who told me that she had *Liparis lilifolia* growing in her woodlot. I was skeptical of her identification, since this species had not been reported previously in Ontario, and since the province is not included in the range given for the species in Gray's Manual. I was invited to visit the site this year, and on June 18th, accompanied by several friends, I went to Komoka and was delighted to see *Liparis lilifolia* (L.) Richard for the first time. It was growing in a predominantly beech-maple woods on the southwest facing slope of the Oxbow Creek, among herbaceous species usually found in this type of woods. Mrs. Higgins told us that this year she had counted 83 plants and she first noticed the orchid in this vicinity about 10 to 15 years ago. Photographs were taken, and Prof. Montgomery took one specimen for the herbarium of the Ontario Agricultural College, Guelph.

On July 10th, on my return trip from observing orchids in the vicinity of Moosonee, James Bay, I visited Timmins, Ont., and was shown *Orchis purpurella* T. & T. A. Stephenson by Mr. Fred Cowell, local naturalist and nature photographer. About 20 plants were found growing along the margin of Gillies Lake in the town of Timmins. Prof. Montgomery and I revisited the stand on July 16th and observed that the lake shore at this point had been filled in with rock, sand and gravel to make room for a roadway. The local residents occasionally discarded waste along this roadway, and the remains of packing material was still evident among the grass and weeds which made up most of the plant cover. It was probably the source of this orchid, native to Europe and Asia.

Specimens have been deposited in the herbarium of the Ontario Agricultural College, Guelph, and of the National Museum of Canada, Ottawa. — H. ANDREWS, ROYAL ONTARIO MUSEUM, TORONTO, ONT.

A RANGE EXTENSION FOR PARAPHOLIS INCURVA. — On May 4, 1960, specimens of *Parapholis incurva* (L.) C. E. Hubb. were collected (R. J. Lemaire 650) on Freemason Island, St. Bernard Parish, Louisiana. The various manuals report this grass, introduced from Europe, as occurring in the United States along the Atlantic coast from New Jersey and Pennsylvania to Virginia, on the Pacific coast in California and Oregon (Portland), and in Michigan.

Since it appeared that a significant range extension for the species may be represented by this collection, a search was made of the limited amount of pertinent literature available to me, concerned with the states bordering the Gulf of Mexico. No published record of the species for Louisana or the gulf coast was found.

Subsequent correspondence with Dr. Jason R. Swallen of the U. S. National Herbarium established that two collections had previously been made on the gulf coast, both in Refugio County, Texas. Swallen collected this grass between Aransas Pass and Rockport (10276), and Whitehouse collected it at Bayside (21209). The collection site on Free-

mason Island is about 485 miles east of the Texas records and appears to be a first record for Louisiana.

Freemason Island is a small, elongated, sand and shell island in the Gulf of Mexico about 40 miles south of Biloxi, Mississippi and about 6 miles west of the main north-south arc of the Chandeleur Islands.

Several small colonies of this grass were observed on the higher (three to four feet above mean gulf level) parts of the island. Some of the associated plants were *Lepidium virginicum* L., *Oenothera humifusa* Nutt., *Sonchus oleraceus* L., *Solidago sempervirens* var. *mexicana* (L.) Fern., and *Chloris petraea* Swartz.

Specimens have been deposited in the herbaria of Tulane University, New Orleans, Louisiana; Southwestern Louisiana University, Lafayette; Florida State University, Tallahassee; and the U. S. National Herbarium, Washington, D. C. — R. J. LEMAIRE, U. S. FISH AND WILDLIFE SERVICE, GRAND ISLAND, NEBRASKA.

A NEW SPECIES OF HAPLOPAPPUS FROM MEXICO. — **Haplopappus rhizomatus** sp. nov. Plantae perennes, fasciculos laxos ad 20 cm. alt., ad 100 cm. lat. formantes; rhizomata 2-3 mm. crass. longa ramosa; internodi 1-2 mm. long. Folia linearilanceolata, 3-4 cm. long., 2 mm., lat., spinuloso-mucronata, marginibus integris, fimbrias villosas habentibus. Pedunculi breviores quam 1 cm. Capitula singula terminalia radiata, ca. 1 cm. diam. Receptaculum fimbrillatum. Phyllaria maculis apicalibus herbaceis perspicuis subviridibus praedita. Achaenia copiose sericeo-pubescentia. Pappus e setis multis inaequis grossis rigidis antrorsaliter barbellatis luteo-albidis constans.

Subcespitose, very leafy, pubescent, perennial herbs forming loose clumps 15-20 cm. tall and 50-100 cm. across; rhizomes 2-3 mm. thick, rather elongated and branching. Stems 1-2 mm. thick, arcuate-erect, the branches many, diverging at low angles (30-40°); internodes only 1-2 mm. long or to 7 mm. just beneath the heads, sordid-cinereous with rather closely-set antrorse villous hairs. Leaves alternate, sessile, linear-lanceolate, near midstem 3-4 cm. long but reduced to

1-2 cm. just beneath the heads, ca. 2 mm. broad, apically acuminate and spinulose-mucronate, basally subamplexicaul, marginally entire, tending to roll upwards on drying and with a dense fringe of villous hairs, especially toward the base, superficially sordid olive-green and sparsely appressed pubescent with antrorse villous hairs, with an inconspicuous midvein and a close inconspicuous network of dark lateral veins. Peduncles mostly shorter than 1 cm. Heads solitary and terminal on each branch, ca. 1 cm. in diameter, radiate. Receptacle slightly convex, 4-5 mm. in diameter, alveolate and fimbrillate with irregularly subulate-lobed, persistent, chaffy structures ca. 0.7 mm. long surrounding the points of attachment of the florets. Involucre broadly campanulate, ca. 5 mm. high (entire structure reflexed after deciduation of the achenes); phyllaries in ca. 3 ranks, lanceolate, the inner phyllaries longest, whitish chartaceous but with prominent greenish herbaceous tip-spots which are produced downward into narrow green mid-lines, the outer phyllaries short and mostly green-herbaceous. Ray-florets ca. 15-20 per head, pistillate and fertile, the corolla tube narrow, ca. 2-3 mm. long, the ligule yellow, oblong to oblanceolate, 6-8 mm. long, apically shortly acute. Disk-florets 40-60 per head, perfect, the corolla yellow, narrowly tubular, ca. 4.5 mm. long, 5-toothed. Achenes of the ray-florets shorter than those of the disk but otherwise similar, 1-1.5 mm. long, trigonally or tetragonally prismatic, copiously pubescent with long silky-white stiffly ascending hairs. Pappus of the disk longer than that of the ray-florets but otherwise similar, of 70-100 coarse stiff antrorsely-barbellated, buffy-white bristles very unequal in length, the longest of the disk ca. 4 mm. long, and of the ray-florets ca. 3 mm. long. Gametic chromosome number as determined by B. L. Turner from pollen mother cells, $n=4$.

TYPE: Nuevo León, Saltillo-Matehuala highway 5 miles north of the junction of the side road to Galeana, elev. ca. 6,000 ft., *J. Graham and M. C. Johnston 4203*, October 8, 1959. Holotype in the herbarium of the University of Texas, isotypes in the herbaria of the Universidad Nacional de México and the University of Kansas.

The species is known only from the type collection. Only a few of these plants were seen. They grew on the road embankment of a highway which was scarcely five years old, indicating a relatively short age and perhaps a weedy tendency. The surrounding country is a high, intermontane desert plain of interior, or in places karst, drainage, with fine calcareous subsaline or alkaline soil. The plain is a vast prairie-dog town. It lies in the rain shadow of the high Cerro Potosí (ca. 12,500 ft.) and adjacent mountains, to the east.

The closest relationship of this species seems to be to one of the "subspecies" of *Haplopappus lanceolatus* (Hook.) T. & G., as treated by H. M. Hall (The Genus Haplopappus . . . , Carn. Inst. Publ. 389, pp. 114-120, 1928) showing reduction of the "inflorescence." But that our plants are substantially distinct is evident from a study of herbarium specimens and of Hall's work, and is attested to by the specialist in the genus, Dr. Ray C. Jackson of the University of Kansas, who kindly examined isotype material.

The type locality and surrounding area were searched in the fall of 1960, but no further plants of this species were found. It seems desirable to place the species on record even though it is known only from the one collection. This collection was made during field study in northeastern Mexico supported by the National Science Foundation through NSF-G9234 at the Plant Research Institute, The University of Texas, and carried out under the direction of Dr. Calvin McMillan. The Latin diagnosis is the work of Hannah Croasdale. — MARSHALL C. JOHNSTON, THE PLANT RESEARCH INSTITUTE, THE UNIVERSITY OF TEXAS, AUSTIN.

CONTEMPORARY NOTES ON POWELL'S EXPEDITIONS IN THE WEST[1]. — From the book's foreword we learn that this is a supplement to a chapter [ten] of Prof. Watson's *Illinois Wesleyan Story: 1850-1950* (Ill. Wesleyan Univ. Press, 1950) prepared by his widow, Julia S. Watson. Had not this journalism instructor retrieved these reports of the per-

[1] *Professor Goes West: Illinois Wesleyan University — Reports of Major John Wesley Powell's Expeditions: 1867-1874.* Edited by Elmo Scott Watson. Illinois Wesleyan Univ. Press, Bloomington, 1954. 138 pp. Sold exclusively by Frank Glenn, bookseller, 627 E. 46 St., Kansas City, Mo. $3.00.

sonnel, routes, and general results of the various expeditions from contemporary newspaper accounts, they would rest unnoticed in the files of the *Chicago Tribune*, *Rocky Mountain News*, *Western Mountaineer*, etc., and the forgotten issues of the Illinois Wesleyan *Alumni Journal*. Our botanical interest in this book centers around ascertaining more exact localities for the plant collections made on the various surveys of Major Powell and his associates, than those recorded in the literature (e.g. *Amaranthus powellii* S. Wats.). The reader will be only partially successful on this score but here are recorded now in more accessible form the names of the persons who accompanied Powell and some information on their itineraries. For example, the precise identity of Mrs. Almon Harris Thompson (*née* Ellen Powell), the sister of Major Powell, is established as the object of commemoration in the name *Astragalus thompsoniae* S. Wats.; the early Illinois years of George Vasey are alluded to; random notes are woven into the reports of Francis Marion Bishop (1843-1933), a student of Powell who later became professor of natural science at the University of Deseret, then politician, judge, and bailiff. Incidentally, the answer to my query on the captaincy of Bishop (*Rocky Mountain Naturalists*, 165) is answered by Ralph V. Chamberlain, *Life Sciences at the University of Utah: background and history* (Salt Lake City, 1950), a useful collateral reference book for the *Professor Goes West* and in general for the history of biological exploration in the Far West.

An index is sadly missed and Prof. Watson made no exhaustive search in the Illinois Wesleyan University records to learn the full identity of all the persons mentioned in the narrative. However, for an unhurried story of Major Powell and his parties of students in the Old West here is good reading. Certainly these expeditions were among the first field laboratory attempts in this country which set off a succession of college-sponsored excursions. — JOSEPH EWAN, TULANE UNIVERSITY, NEW ORLEANS, LA.

Volume 63, No. 749, including pages 121-150, was issued June 15, 1961.